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Humor perception in schizophrenia appears to be related to disorganization syndrome☆

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ABSTRACT

Perception of humor seems to be often disturbed in schizophrenia, yet current literature is limited and ambiguous on its relationship to psychopathology. A sample of 40 schizophrenia-diagnosed subjects provided humor comprehension and funniness ratings for 60 cartoons and 60 stories with funny, neutral and absurd punchlines. Disorganization syndrome was found to associate with deficits in humor comprehension and experienced funniness in non-humorous stimuli after controlling for cognitive performance, age, sex and medication. The findings are discussed in relation to previous studies on the topic.

1. Introduction

Perception of humor is a complex cognitive-emotional phenomenon which has been found to be disturbed in people with schizophrenia. Although defining humor is not an easy task, there are some popular conceptualizations [1–3]. They are generally based on the idea of reinterpretation of a story to accommodate a surprising, seemingly incongruous element and the effect of this reinterpretation evoking the feeling of funniness. It is commonly accepted that perception of humor is an important ability in social communication. In research, it was usually narrowed to reception of jokes and this was found impaired in schizophrenia. In particular, previous studies revealed its relation to cognitive performance such as working memory, verbal fluency, and ability to sustain selective attention [4], executive and general intellectual functioning, and social reasoning [5,6]. Other studies indicated that jokes requiring mentalizing ability are especially difficult for this population [7,8]. While associations found between cognitive skills and humor comprehension may vary, such findings indicate the need to account for the cognitive ability when evaluating humor. As far as psychopathological symptoms are concerned, their associations with deficits in "getting jokes" differ among studies as well. While some found no significant relationships [4,8], in other either total psychopathology score [5], positive syndrome [9], cognitive symptoms [9,10] or specifically delusions, avolition and apathy, and depression [6] were associated with diminished recognition of humor.

This study attempted to shed more light on the relationship between psychopathological symptoms and the ability to comprehend and appreciate humor in schizophrenia. As opposed to the previous research, it also investigated whether indicating absurd or neutral stories or cartoons as comprehensible and funny is related to psychopathology. The humor task was based on that of Chan et al. [11] whereas psychopathology assessment was based on the findings of van der Gaag et al. [12]. Therefore, this was an exploratory study; however, given the findings of previous reports, we expected humor measures to associate with symptoms, especially disorganization syndrome, which is most closely related to cognitive deficits. Additionally, we were interested whether basic indicators of the course of illness, such as the number of hospitalizations or illness duration would be related to the humor processing ability.

2. Method

Forty outpatients with schizophrenia, diagnosed by experienced psychiatrists on the basis of clinical interviews and medical documentation, were recruited through advertising from a local network of community psychiatry institutions in Kraków, Poland. All participants had no history of brain disease, head injuries, seizures, substance abuse or current serious somatic illnesses. All were right-handed and native Polish speakers. All subjects gave their informed consent to participate and received remuneration. The study procedures conformed to the ethical standards of the Declaration of Helsinki and were approved by the Bioethical Committee at the Jagiellonian University in Kraków, Poland.

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All subjects had been evaluated with PANSS [13] to assess the severity of psychopathology and with MoCA [14] to assess their general cognitive functioning. PANSS assessment was performed by experienced psychiatrists, whereas demographic data collection, MoCA and humor comprehension and funniness assessments were performed by or were assisted by psychologists. The stimuli for the punchline-based-humor-comprehension-task [15,16] were preselected based on 1–9 Likert-type scale comprehension and funniness ratings performed by 60 healthy volunteers (judges). Thus, the 60 stories adopted for funny, neutral and absurd stimuli had respective mean ± sd ratings of comprehension: 8.30 ± 0.29, 6.86 ± 0.64 and 2.48 ± 1.09, and of funniness: 6.76 ± 0.54, 2.22 ± 0.52 and 1.85 ± 0.50. The analogous ratings for 60 cartoons equaled 7.92 ± 0.42, 6.76 ± 0.66 and 2.84 ± 0.96 for comprehension, and 6.10 ± 0.57, 2.51 ± 0.60 and 2.02 ± 0.46 for funniness. The proper humor task consisted of two separate runs of 60 stories and 60 cartoons, each with randomly ordered 20 items per one of three types of punchlines/captions: funny, neutral (non-funny) and absurd. Every subject was administered all 120 stimuli and the procedure took nearly 1 h to complete. For every stimulus, the subject read the setup of a story without punchline (8–50 words) presented for 18 s, or looked at a cartoon without a caption presented for 8 s, then the punchline (2–12 words) or balloon caption (2–17 words) appeared for another 8 s. Finally, the subject rated whether the "joke" was comprehensible on a yes/no scale which was followed by rating of funniness of the "joke" on a Likert-type 1–9 scale (1 — not funny at all; 9 — very funny) with no time constraint. The humor tasks were created using PsychoPy v1.82.01 software [17] and run on a pc with a 24 inch screen. Before both humor tasks, the participants rated 3 examples to get accustomed to the procedure. Sample stories with funny, neutral and absurd punchlines are presented below:

Funny:	Two friends chat: – I'd read so much about how alcohol is bad for you, that I finally said to myself: time to end it once and for all! – Drinking? – No, reading.
Neutral:	A patient runs out of a dentist's office. His wife asks: – How was it? – He pulled two out. – But only one was hurting, wasn't it? – Both were decayed.
Absurd:	A wife calls husband: – Honey, a mirror has fallen off in our car… – How did it happen? – I burned milk this morning.

Scores for stories and cartoons were combined and calculated for comprehension and funniness ratings of absurd, neutral and funny punchlines/captions. Humor comprehension and funniness indices were analyzed for correlations with total PANSS score and scores for five syndromes (based on PANSS items confirmed in all analyzed studies by van der Gaag et al. [12]). Besides symptoms, we also included three measures of the course of illness, namely duration of illness in years, number of hospitalizations, and the latter divided by the former, which we called "illness severity". Additional correlations with MoCA score, age, dose of neuroleptics and sex were calculated to give the reader a more informed view prior to controlling for these variables in partial correlations. Pearson correlation coefficients were calculated with bootstrapped bias-corrected and accelerated confidence intervals based on 5000 samples. All calculations were performed using IBM SPSS Statistics 25 package. The demographic and clinical data are presented in Table 1.

Table 1
Demographic and clinical characteristics of the sample ($n = 40$).

Demographic/clinical variable	Range	Mean (sd)
Age	24–64	42.6 (10.1)
Years of education	8–21	14.8 (2.9)
MoCA score	16–30	23.9 (3.2)
Duration of illness (years)	3–44	19.4 (10.1)
Number of psychiatric hospitalizations	1–24	7.7 (5.1)
Neuroleptics (chlorpromazine equivalent)	0–1350	440.0 (298.8)
PANSS total score	31–106	57.4 (18.3)
PANSS positive	5–24	10.7 (4.8)
PANSS negative	8–33	15.8 (7.2)
PANSS disorganization	5–19	8.8 (4.1)
PANSS excitement	4–12	6.1 (2.4)
PANSS emotional distress	4–17	8.4 (3.0)
Diagnosis:	*n*	%
Paranoid schizophrenia	34	85.0
Undifferentiated schizophrenia	2	5.0
Simple schizophrenia	1	2.5
Schizoaffective disorder	3	7.5
Neuroleptics:	*n*	%
None	1	2.5
Typical	1	2.5
Atypical	27	67.5
Mixed	11	27.5
Additional medication:	*n*	%
Anxiolytics	5	12.5
Antidepressants	6	15.0
Mood stabilizers	8	20.0

Typical neuroleptics included: flupentixol, haloperidol, hydroxyzine, levomepromazine, perazine, promazine.
Atypical neuroleptics included: amisulpride, clozapine, olanzapine, risperidone, sulpiride, quetiapine, aripiprazole.
Antidepressants included: clomipramine, escitalopram, fluoxetine, imipramine, mianserin, sertraline, venlafaxine.
Anxiolytics included: alprazolam, clonazepam, hydroxyzine, propranolol, hydrochloride.
Mood stabilizers included: carbamazepine, lithium, valproic acid.

3. Results

Correlational analyses revealed several significant correlations of humor comprehension and funniness ratings with psychopathological symptoms and other clinical data, which are presented in Table 2.

However, after controlling for MoCA score, age, sex and neuroleptic dosage there were only four statistically significant partial correlations. Disorganization syndrome remained associated with comprehension of funny stimuli ($r = -0.394$, with 95% BCa CI [−0.641, −0.121]) and with funniness of absurd and neutral stimuli ($r = 0.466$ [0.156, 0.691] and $r = 0.428$ [0.119, 0.659], respectively). Moreover, comprehension of neutral stimuli was associated with number of psychiatric hospitalizations ($r = -0.232$ [−0.494, −0.004]).

4. Discussion

The present study results point to several conclusions. First, humor reception seems to be associated with the severity of symptomatology, which manifests both in the understanding of humorous material, as well as in the subjective appreciation of funniness of a material not intended to be humorous. Second, cognitive functioning, which is generally declined in schizophrenia [18], is also associated with deficits in humor reception [4–6] and therefore needs to be accounted for when evaluating the role of symptoms. One could argue that it may be self-defeating, as humor reception is itself a complex cognitive phenomenon. However, we decided to control for general neurocognitive ability, to evaluate whether symptoms might capture something over and above that in relation to the humor deficit. After controlling also for age, sex and neuroleptics, the findings show that disorganization syndrome still maintains significant associations with comprehension and funniness assessments. This would indicate that disorganization assessment captures some deficit which may elude short cognitive evaluation. Polimeni and Reiss [10] had screened their subjects for normal cognitive function and also found cognitive syndrome significant, whereas Polimeni et al. [5] reported only total PANSS score's association with humor. Corcoran et al. [7] reported that a subgroup with negative and cognitive symptoms performed weakest, although their symptom

Table 2
Significant zero-order Pearson correlation coefficients between humor task ratings and clinical data (significance based on bootstrapped bias-corrected and accelerated 95% confidence intervals).

	Comprehension score			Funniness score		
	Absurd	Neutral	Funny	Absurd	Neutral	Funny
PANSS total			−0.32* [−0.55, −0.09]	0.41** [0.21, 0.58]	0.47** [0.26, 0.66]	
PANSS positive			−0.34* [−0.61, −0.05]	0.26 [0.04, 0.48]	0.33* [0.05, 0.57]	
PANSS negative					0.28 [0.00, 0.53]	
PANSS disorganization			−0.44** [−0.68, −0.16]	0.57** [0.35, 0.74]	0.60** [0.40, 0.76]	
PANSS excitement					0.43** [0.13, 0.67]	
PANSS emotional distress						0.34* [0.02, 0.59]
Duration of illness	−0.30 [−0.54, −0.02]			0.35* [0.08, 0.61]	0.28 [0.01, 0.54]	
Number of hospitalizations		−0.22 [−0.46, −0.02]				
Illness severity[a]				−0.29 [−0.49, −0.05]		
MoCA score	0.44** [0.18, 0.69]			−0.37* [−0.57, −0.08]	−0.49** [−0.68, −0.24]	
Age				0.33* [0.06, 0.56]	0.36* [0.09, 0.59]	0.40* [0.10, 0.65]
Neuroleptics dosage (no sig. corr.)						
Sex (no sig. corr.)						

Square brackets denote bootstrapped BCa 95% confidence intervals (based on 5000 samples).
Asterisks denote 0.05 (*) and 0.01 (**) significance based on normal distribution.
[a] Illness severity indicator is calculated as number of hospitalizations divided by years with illness.

evaluation differs vastly from ours and other studies. On the other hand, both Bozikas et al. [4], who calculated cognitive impairment score from PANSS (mirroring disorganization in our study) and Marjoram et al. [8] found no significant relationship of symptoms with humor recognition. However, their humor tasks differed from ours as they used captionless cartoons and half required mentalizing. This could have affected the results since mentalizing was found to be deficient even in highly functioning schizophrenia patients [19]. Similarly, lack of verbal stimuli may also impede performance in schizophrenia [20]. Lastly, Stratta et al. [9], also using captionless stimuli, found associations of the original positive syndrome of PANSS (including conceptual disorganization) with humor comprehension and funniness ratings, whereas cognitive symptom cluster was related to lesser perceived difficulty in understanding jokes requiring mentalizing. Still, syndromes so defined are not exactly congruent with those in our study and funniness was analyzed only for the correct responses. Third, disorganization syndrome remained associated not only with comprehension of actual jokes, which seems self-explanatory, but also with rating non-funny or even absurd stimuli as funny. This may be a phenomenon similar to one suggested by Marjoram et al. [8], that is, the expectation of jokes, inherent in the procedure of rating funniness, coupled with difficulties in recognizing humor, leading to a kind of blind guessing. On the other hand, the funniness, being a strongly subjective experience, might indeed be there for more disorganized subjects. In fact, these conjectures are not mutually exclusive. Unfortunately, other researchers did not report on the funniness ratings of non-humorous stimuli. However, Stratta et al.'s [9] finding of cognitive syndrome association seems supportive of the idea of feigning humor recognition. Finally, we found number of hospitalizations to be weakly inversely related to comprehension of neutral stimuli suggesting that the burden of illness may affect cognitive ability even when age and basic cognitive skills are accounted for.

The associations between humor and disorganization could possibly be further explained by poor use of contextual information in schizophrenia (e.g. [26,27]), as it was found to associate with disorganization [21]. Moreover, so were social cognition and verbal intelligence [22–25]. This is in line with our current findings, linking disorganization severity to humor comprehension and appreciation, as they are complex skills usually utilized in social settings.

On a last note, we need to reiterate that the humor task was created for the purpose of this study and although care was taken to exclude jokes with potentially offensive content, the results must be treated with proper caution, as the task was not standardized in a representative sample and in other cultural contexts. In addition, due to the exploratory nature of the analyses and to facilitate comparisons with other reports, no alpha corrections were employed. Therefore, further corroborations of these findings are needed. All in all, disorganization symptoms seem worthy of further research in terms of humor perception deficits in schizophrenia.

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References

[1] Veatch TC. A theory of humor. Humor 1998;11:161–215. https://doi.org/10.1515/humr.1998.11.2.161.
[2] Wyer RS, Collins JE. A theory of humor elicitation. Psychol Rev 1992;99:663–88. https://doi.org/10.1037/0033-295x.99.4.663.
[3] Hurley MM, Dennett DC, Adams RB. Inside jokes: using humor to reverse-engineer the mind. Cambridge, Mass: MIT Press; 2011.
[4] Bozikas VP, Kosmidis MH, Giannakou M, Anezoulaki D, Petrikis P, Fokas K, et al. Humor appreciation deficit in schizophrenia: the relevance of basic neurocognitive functioning. J Nerv Ment Dis 2007;195:325–31. https://doi.org/10.1097/01.nmd.0000243798.10242.e2.
[5] Polimeni JO, Campbell DW, Gill D, Sawatzky BL, Reiss JP. Diminished humour perception in schizophrenia: relationship to social and cognitive functioning. J Psychiatr Res 2010;44:434–40. https://doi.org/10.1016/j.jpsychires.2009.10.003.
[6] Tsoi DT-Y, Lee K-H, Gee KA, Holden KL, Parks RW, Woodruff PWR. Humour experience in schizophrenia: relationship with executive dysfunction and psychosocial impairment. Psychol Med 2008;38:801–10. https://doi.org/10.1017/S0033291707002528.

[7] Corcoran R, Cahill C, Frith CD. The appreciation of visual jokes in people with schizophrenia: a study of "mentalizing" ability. Schizophr Res 1997;24:319–27.
[8] Marjoram D, Tansley H, Miller P, MacIntyre D, Owens DGC, Johnstone EC, et al. A Theory of Mind investigation into the appreciation of visual jokes in schizophrenia. BMC Psychiatry 2005;5. https://doi.org/10.1186/1471-244X-5-12.
[9] Stratta P, Riccardi I, Mirabilio D, Tommaso SD, Tomassini A, Rossi A. Exploration of irony appreciation in schizophrenia. Eur Arch Psychiatry Clin Neurosci 2007;257:337–9. https://doi.org/10.1007/s00406-007-0729-z.
[10] Polimeni J, Reiss JP. Humor perception deficits in schizophrenia. Psychiatry Res 2006;141:229–32. https://doi.org/10.1016/j.psychres.2005.05.012.
[11] Chan Y-C, Chou T-L, Chen H-C, Yeh Y-C, Lavallee JP, Liang K-C, et al. Towards a neural circuit model of verbal humor processing: an fMRI study of the neural substrates of incongruity detection and resolution. NeuroImage 2013;66:169–76. https://doi.org/10.1016/j.neuroimage.2012.10.019.
[12] van der Gaag M, Hoffman T, Remijsen M, Hijman R, de Haan L, van Meijel B, et al. The five-factor model of the Positive and Negative Syndrome Scale II: a ten-fold cross-validation of a revised model. Schizophr Res 2006;85:280–7. https://doi.org/10.1016/j.schres.2006.03.021.
[13] Kay SR, Fiszbein A, Opler LA. The positive and negative syndrome scale (PANSS) for schizophrenia. Schizophr Bull 1987;13:261–76.
[14] Nasreddine ZS, Phillips NA, Bédirian V, Charbonneau S, Whitehead V, Collin I, et al. The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. J Am Geriatr Soc 2005;53:695–9. https://doi.org/10.1111/j.1532-5415.2005.53221.x.
[15] Adamczyk P, Wyczesany M, Daren A. Dynamics of impaired humour processing in schizophrenia — an EEG effective connectivity study. Schizophr Res 2019;209:113–28. https://doi.org/10.1016/j.schres.2019.05.008.
[16] Adamczyk P, Wyczesany M, Domagalik A, Daren A, Cepuch K, Błądziński P, et al. Neural circuit of verbal humor comprehension in schizophrenia — an fMRI study. NeuroImage Clin 2017;15:525–40. https://doi.org/10.1016/j.nicl.2017.06.005.
[17] Peirce JW. Generating stimuli for neuroscience using PsychoPy. Front Neuroinform 2009;2. https://doi.org/10.3389/neuro.11.010.2008.
[18] Nuechterlein KH, Barch DM, Gold JM, Goldberg TE, Green MF, Heaton RK. Identification of separable cognitive factors in schizophrenia. Schizophr Res 2004;72:29–39. https://doi.org/10.1016/j.schres.2004.09.007.
[19] Varga E, Schnell Z, Tényi T, Németh N, Simon M, Hajnal A, et al. Compensatory effect of general cognitive skills on non-literal language processing in schizophrenia: a preliminary study. J Neurolinguistics 2014;29:1–16. https://doi.org/10.1016/j.jneuroling.2014.01.001.
[20] Sarfati Y, Passerieux C, Hardy-Baylé M-C. Can verbalization remedy the Theory of Mind deficit in schizophrenia? Psychopathology 2000;33:246–51. https://doi.org/10.1159/000029153.
[21] Horton HK, Silverstein SM. Visual context processing deficits in schizophrenia: effects of deafness and disorganization. Schizophr Bull 2011;37:716–26. https://doi.org/10.1093/schbul/sbr055.
[22] Allen DN, Strauss GP, Donohue B, van Kammen DP. Factor analytic support for social cognition as a separable cognitive domain in schizophrenia. Schizophr Res 2007;93:325–33. https://doi.org/10.1016/j.schres.2007.02.008.
[23] Minor KS, Lysaker PH. Necessary, but not sufficient: links between neurocognition, social cognition, and metacognition in schizophrenia are moderated by disorganized symptoms. Schizophr Res 2014;159:198–204. https://doi.org/10.1016/j.schres.2014.08.005.
[24] O'Leary DS, Flaum M, Kesler ML, Flashman LA, Arndt S, Andreasen NC. Cognitive correlates of the negative, disorganized, and psychotic symptom dimensions of schizophrenia. J Neuropsychiatry Clin Neurosci 2000;12:4–15. https://doi.org/10.1176/jnp.12.1.4.
[25] Ventura J, Wood RC, Hellemann GS. Symptom domains and neurocognitive functioning can help differentiate social cognitive processes in schizophrenia: a meta-analysis. Schizophr Bull 2013;39:102–11. https://doi.org/10.1093/schbul/sbr067.
[26] Chung YS, Barch D, Strube M. A meta-analysis of mentalizing impairments in adults with schizophrenia and autism spectrum disorder. Schizophr Bull 2014;40:602–16. https://doi.org/10.1093/schbul/sbt048.
[27] Penn DL, Ritchie M, Francis J, Combs D, Martin J. Social perception in schizophrenia: the role of context. Psychiatry Res 2002;109:149–59. https://doi.org/10.1016/S0165-1781(02)00004-5.